

# Tree structure and diversity of coffee-based agroforests and natural forest in Guinée Forestière (Guinea, West Africa)

**I**N the current deforestation context, agroforestry is increasingly considered in the tropical zone for its potential contribution to biodiversity conservation. In Guinée Forestière (Guinea, West Africa), coffee-based agroforests are currently expanding on agricultural land near villages (Lamanda et al. 2007).



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## Methods

To assess the biodiversity potential of coffee-based agroforests of Guinée forestière, we compared tree structure and diversity to a neighbouring natural forest. Eighty plots were sampled with a “variable area transect” method (Sheil et al. 2003) (60 plots distributed into 3 village agroforests, and 20 natural forest plots).

## Results

### Structure and tree diversity of coffee-based agroforests:

- Confirmed clear indicators of farmer management with the density of mature trees significantly lower than in natural forests and the majority of juvenile trees eliminated and replaced by coffee trees (Figure 1).
- High species richness (Table 1) and a tree seedling density similar to that of the natural forest (Figure 1).
- Forty two to sixty percent of the 1417 mature trees encountered in the agroforests were fruit trees (mainly *Cola nitida* and *Elaeis guineensis*). The remaining mature trees were predominately commercial timber and/or shade tree species (*Terminalia* spp., *Milicia excelsa*, *Albizia* spp.), and medicinal tree species.

This diverse portfolio of multiple uses is the result of farmer practices; most trees have been planted and carefully selected to build a functional tree cover.

### Tree species richness and diversity were also lower than in natural forest but much higher than in any other agricultural or agroforestry land use system:

- A total of 174 species of trees above 10 cm DBH were recorded in the Ziama forest and the three agroforests. Within coffee-based agroforests, 9 species are classified as vulnerable (IUCN 2008).
  - The similarity indices reflect a comparable mature tree composition (Table 2) and abundance distribution in the three agroforests (Table 3).
  - Forty percent of the tree species recorded in the Ziama forest were found in the agroforests but these forest species were represented by only a few individuals within coffee-based agroforests and / or they were present in only one of the three agroforests.
- Coffee-based agroforests have a conservational role but cannot be considered as a substitute for protected forests.

Table 1: Diversity of mature trees (DBH> 10cm). Species richness estimators and diversity indices were calculated with N min. = 376

	Boussédou	Boo	Nienh	Natural Forest
N	583	458	376	795
S	66	64	46	134
Rarefaction	54	60	46	102
Chao 1	75	76	53	222
ACE	88	77	52	183
Simpson (1/D)	9.20	10.30	5.74	43.44
Shannon	2.90	3.06	2.53	4.27
Fisher's Alpha	16.70	19.50	13.76	46.17

Table 2: Similarities between studsites for mature trees (Sorensen index).

	Boussédou	Boo	Nienh	Natural Forest
Boussédou	-	0.620	0.660	0.381
Boo		-	0.666	0.414
Nienh			-	0.364

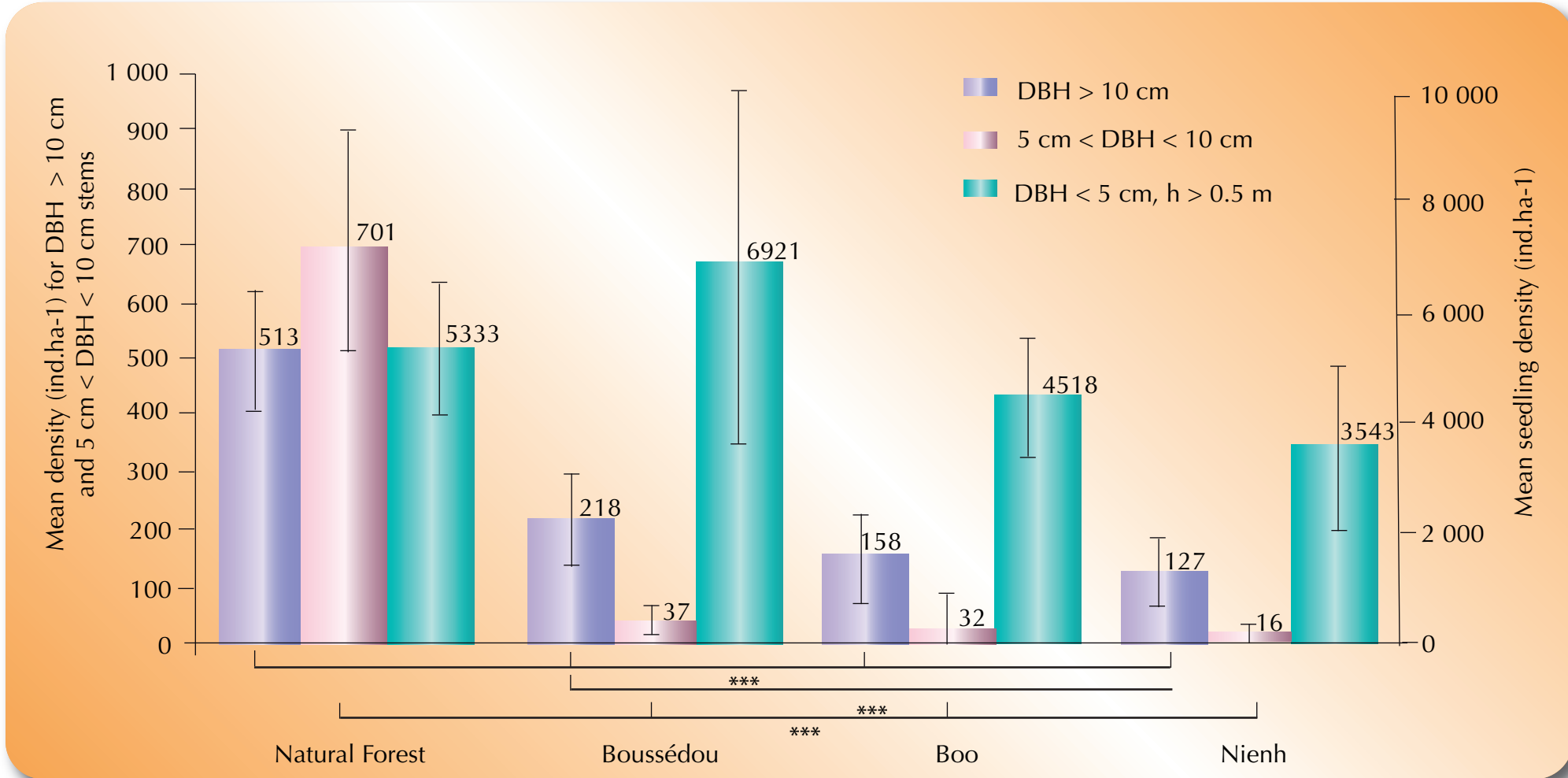


Figure 1: Mean density of the 3 size classes of trees on each site. Bars below the graph point significant differences between the sites (\*\*\*) =  $p < 0.001$

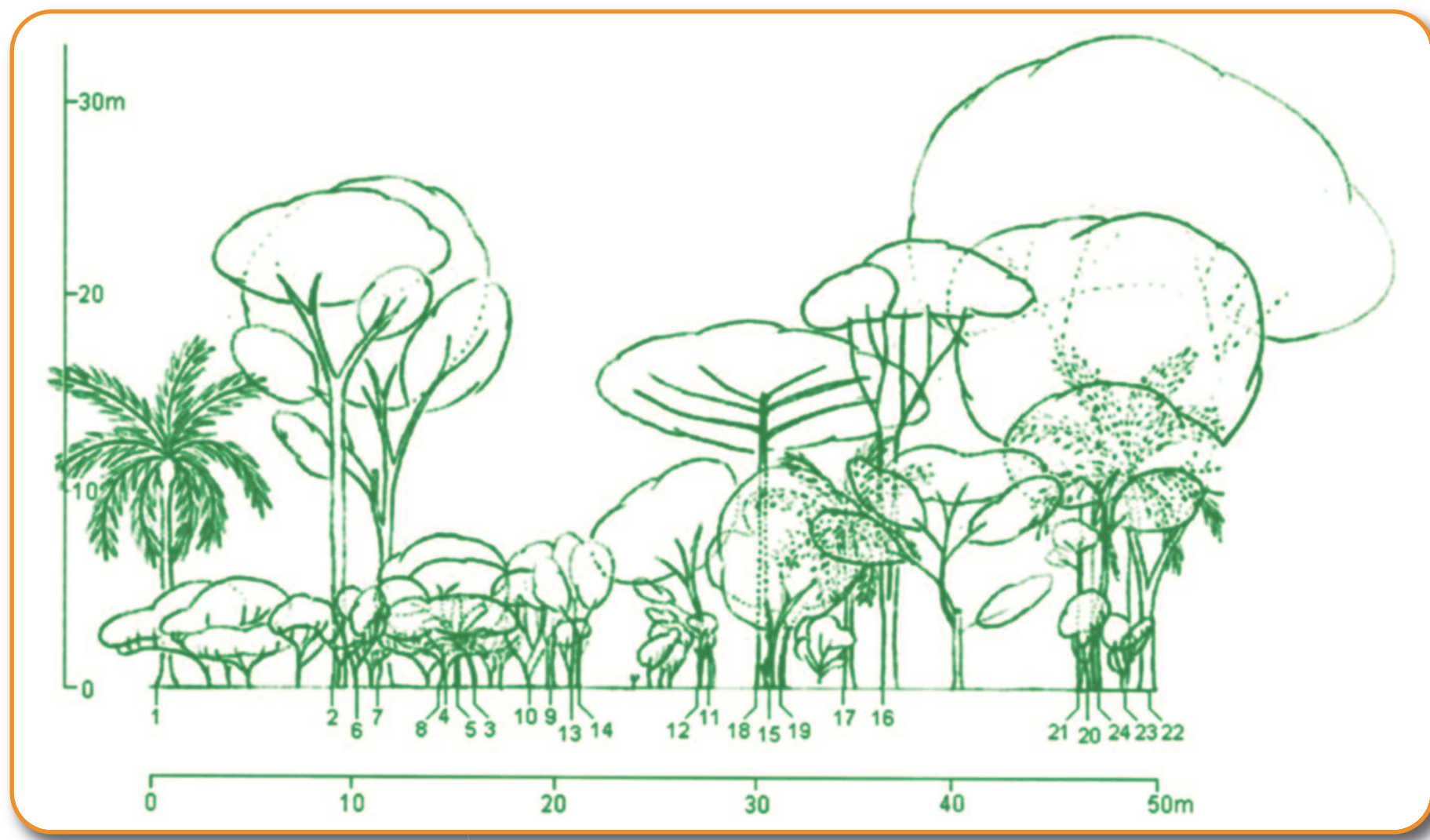


Figure 2: Architectural profile of a coffee-based agroforestry (from Diabaté et al. 2007). Coffee trees are poorly represented because only trees and shrubs of DBH> 10cm were illustrated. 1,17,23: *Elaeis guineensis*; 2,7: *Milicia excelsa*; 3,15: *Pancovia bijuga*; 4,8,10: *Coffea canephora*; 5: *Musa sinensis*; 6: *Persea americana*; 9,25: *Albizia zygia*; 11: *Pseudospondias microcarpa*; 12,19: *Dialium dinklagei*; 13,14: *Ficus capensis*; 16: *Funtumia elastica*; 18, 20: *Pycnanthus angolensis*; 21: *Antiaris africana*; 22: *Albizia adianthifolia*; 24: *Sterculia tragacantha*.

Table 3 : Similarities between study sites for mature trees (Morisita-Horn index).

	Boussédou	Boo	Nienh	Natural Forest
Boussédou	-	0.913	0.935	0.087
Boo		-	0.888	0.134
Nienh			-	0.046

## References

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## Conclusions

In Guinée Forestière, part of the coffee-based agroforests has been established by farmers on forest fallow land and part on savannah land. Those farmers, like elsewhere in the humid tropics, are often depicted as the main culprits of deforestation. Here, they represent the main actors of an original reforestation and biodiversity conservation process.

Past local development projects in the area, including those related to coffee production, have promoted specialization and high input practices, and have for the most part failed. Future projects should adopt a more holistic view accounting for the multiple roles coffee-based agroforests play, not only for smallholder producers –income generation, multiple products for household consumption and livelihood improvement, but also for society at large -biodiversity conservation.



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